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February 27, 2001

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Re: Massachusetts v. Kenneth Waters

Docket No. 82-4115

On Habeas Corpus

Our File No. 00-628

Report 2

Background .

Previous work in this case [see our report dated January 29, 2001] concerned PCR based DNA analysis of STR genes from several blood stains found at the Katarina Reitz Brow homicide scene. The most significant blood stains were found on the bathroom rug #3 [Item 1A] and various linens found on the floor of the hallway closet #10A [Item 4A], #10B.1 [Item 5A], #10B.2 [Item 6A], #10D [Item 7A], #10E [Item 8], and #10F [Item 9]. All of these blood stains originated from a single male and produced a highly discriminating genetic profile that would be expected to occur in no more than one in several hundred million members of the population.

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Following this work we requested reference samples from Kenneth Waters and the husband of Katarina Brow. Recently, we received a reference blood sample from Kenneth Waters. It was requested that PCR based DNA typing be conducted to determine whether or not Kenneth Waters can be eliminated as the source of the blood from the bathroom rug #3 [Item 1A] and various linens found on the floor of the hallway closet #10A [Item 4A], #10B.1 [Item 5A], #10B.2 [Item 6A], #10D [Item 7A], #10E [Item 8], and #10F [Item 9].

Items of Physical Evidence

Most of the evidence in this case was described in our previous report dated January 29, 2001. That evidence together with the newly received evidence is listed again here for the sake of clarity and completeness.

The following items of physical evidence were received from Mary Kate McGilvray, Assistant Technical Manager of Forensic Biology with the Commonwealth of Massachusetts, Department of State Police Crime Laboratory in Sudbury, Massachusetts on October 27, 2000 via Federal Express Priority Overnight mail in a sealed envelope:

Item

1. Glassine envelope marked "68709; 3". [unopened at inventory] The letter of transmittal indicates that the envelope contains yellow fibers stained red/brown that were removed from a bathroom rug.
2. Glassine envelope marked "68709; 7". [unopened at inventory] The letter of transmittal indicates that the envelope contains a red/brown stained swatch from a swabbing of the area to the left of the light switch at the turn to the front bedroom.

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3. Glassine envelope marked "68709; 8". [unopened at inventory] The letter of transmittal indicates that the envelope contains a red/brown stained swatch from a swabbing of the wall in the hallway to the right of the entrance to the front bedroom.
4. Glassine envelope marked "68709; 10A". [unopened at inventory] The letter of transmittal indicates that the envelope contains a light (mint) green terry cloth cutting stained red/brown, a sample of the cloth removed from linens and towels on the floor in front of the closet in the hallway.
5. Glassine envelope marked "68709; 10B.1". [unopened at inventory] The letter of transmittal indicates that the envelope contains a white cloth cutting from area 1 stained red/brown, a sample of the cloth removed from linens and towels on the floor in front of the closet in the hallway.
6. Glassine envelope marked "68709; 10B.2". [unopened at inventory] The letter of transmittal indicates that the envelope contains a white cloth cutting from area 2 stained red/brown, a sample of the cloth removed from linens and towels on the floor in front of the closet in the hallway.
7. Glassine envelope marked "68709; 10D". [unopened at inventory] The letter of transmittal indicates that the envelope contains a pink floral print cloth cutting stained red/brown, a sample of the cloth removed from linens and towels on the floor in front of the closet in the hallway.
8. Glassine envelope marked "68709; 10E". [unopened at inventory] The letter of transmittal indicates that the envelope contains a pink cloth cutting stained red/brown, a sample of the cloth removed from linens and towels on the floor in front of the closet in the hallway.

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9. Glassine envelope marked "68709; 10F". [unopened at inventory] The letter of transmittal indicates that the envelope contains a multi-colored floral print cloth cutting stained red/brown, a sample of the cloth removed from linens and towels on the floor in front of the closet in the hallway.
10. Glassine envelope marked "68709; 18, Blade". [unopened at inventory] The letter of transmittal indicates that the envelope contains a swabbing from the blade of the knife that was found in the kitchen wastebasket.
11. Glassine envelope marked "68709; 18, Hilt". [unopened at inventory] The letter of transmittal indicates that the envelope contains a swabbing from the hilt of the knife that was found in the kitchen wastebasket.
12. Glassine envelope marked "68709; 18, Crevice, Side 2". [unopened at inventory] The letter of transmittal indicates that the envelope contains a swabbing from the crevice of the knife that was found in the kitchen wastebasket.
13. Glassine envelope marked "68709; 20". [unopened at inventory] The letter of transmittal indicates that the envelope contains a swatch stained red/brown, a swabbing from the top of the table in the dining area.
14. Glassine envelope marked "68709; 21". [unopened at inventory] The letter of transmittal indicates that the envelope contains brown fibers stained red/brown that were removed from a piece of carpeting from the living room.
15. Glassine envelope marked "68709; Control Swab". [unopened at inventory] The letter of transmittal indicates that this is the control swab for the samples collected from the knife.
16. Evidence photographs: 32 4"x6" photographs, 2 Polaroid photographs.

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The following items of physical evidence were received from Sharon M. Convery, Chemist III in the DNA Unit of the Commonwealth of Massachusetts, Department of State Police Crime Laboratory in Sudbury, Massachusetts on February 14, 2001 via Federal Express Priority Overnight service in a sealed envelope:

17. Envelope marked "Kenneth Waters, MCI Shirley, Inmate #W-39705" containing one similarly marked purple-topped tube of blood. The letter of transmittal indicates that this a reference blood sample for Kenneth Waters.

Examination of the Kenneth Waters Reference Sample #W-39705 [Item 17]

A sealed envelope containing a vial of blood from Kenneth Waters #W-39705 [Item 17] was submitted for examination. The envelope packaging for this blood is illustrated in figure 18. The vial of blood is illustrated in figure 19. A small volume of this blood was removed for DNA extraction and analysis as described below.

Genetic Analysis of DNA

Several genes were amplified using the polymerase chain reaction [PCR] and subsequently typed. These genes include the STR genes known as Profiler Plus [D3S1358, vWA, FGA, D8S1179, D21S11, D18S51, D5S818, D13S317, D7S820]; and amelogenin, a gene that allows sex determination. These genes were described in our previous report dated January 29, 2001.

Genetic analysis of the specimens in this case involved the following essential steps:

1. Blood was digested with SDS and proteinase K.

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2. DNA was extracted from sample digests with chloroform/phenol and concentrated using Centricon molecular filters.
3. The various genes described above were amplified using the Polymerase Chain Reaction [PCR].
4. The STR genes and amelogenin were typed using capillary electrophoresis.

The results of all the analyses in this case are summarized in Table 1. These findings revealed the following observed facts:

Blood from Male #1

1. In our previous work the blood from the bathroom rug #3 [Item 1] in area A was determined to be D3S1358 type 15,17; vWA type 15,17; FGA type 19,23; D8S1179 type 10,13; D21S11 type 30,31.2; D18S51 type 12,15; D5S818 type 12,12; D13S317 type 12,12; and D7S820 type 8,11. This DNA was also determined to originate from a male by analysis of the amelogenin gene. This array of genotypes occurs in significantly less than one out of 100,000 members of the population. The calculated genotype frequencies indicate that it is unlikely that more than one human being has ever possessed this particular genotype array. The frequencies associated with individual genotypes are summarized in Appendix 1 below.
2. In our previous work a low level of human DNA was recovered from the bathroom rug cutting #3 [Item 1] outside the blood stained area [B]. This low level of human DNA does not influence the understanding of the large quantity of human DNA recovered from the blood stained area [A].

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3. In our previous work the blood recovered from various linens on the floor near the hallway closet #10A [Item 4A], #10B.1 [Item 5A], #10B.2 [Item 6A], #10D [Item 7A], #10E [Item 8], and #10F [Item 9] was determined to be D3S1358 type 15,17; vWA type 15,17; FGA type 19,23; D8S1179 type 10,13; D21S11 type 30,31.2; D18S51 type NA; D5S818 type 12,12; D13S317 type 12,12; and D7S820 type NA. This DNA was also determined to originate from a male by analysis of the amelogenin gene. This array of genotypes occurs in significantly less than one out of 100,000 members of the population. The calculated genotype frequencies indicate that it is unlikely that more than one human being out of several hundred million possess this particular genotype array. The frequencies associated with individual genotypes are summarized in Appendix 1 below.
4. While there is slightly less genetic information from the blood on the various linens found near the hallway closet #10A [Item 4A], #10B.1 [Item 5A], #10B.2 [Item 6A], #10D [Item 7A], #10E [Item 8], and #10F [Item 9], the source of this blood is genetically identical to the male source of the blood from the bathroom rug #3 [Item 1].
5. In our previous work the DNA recovered from the blood on the living room carpet #21 [Item 14A] was determined to be D3S1358 type 15,?; vWA type 15,17; FGA type NA; D8S1179 type 10,13; D21S11 type NA; D18S51 type NA; D5S818 type 12,12; D13S317 type NA; and D7S820 type NA. This DNA was also determined to originate from a male by analysis of the amelogenin gene. This DNA was sufficiently degraded that only the smallest genes could be amplified and typed.
6. The source of the male blood from the living room carpet #21 [Item 14A] is genetically compatible with the male blood source from the bathroom rug #3 [Item 1] and the linens found near the Hallway closet #10A [Item 4A], #10B.1 [Item 5A], #10B.2 [Item 6A], #10D [Item 7A], #10E [Item 8], and #10F [Item 9].

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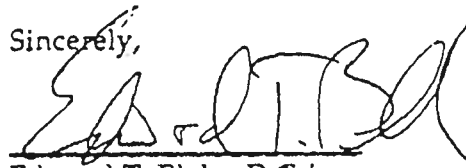
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Kenneth Waters
Item 17

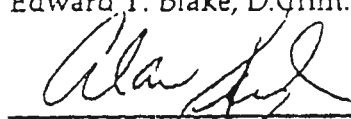
7. In our current work Kenneth Waters was determined to be D3S1358 type 16,18; vWA type 14,17; FGA type 21,22; D8S1179 type 10,15; D21S11 type 29,29; D18S51 type 13,15; D5S818 type 12,13; D13S317 type 8,11; and D7S820 type 10,12. This DNA was also determined to originate from a male by analysis of the amelogenin gene.
8. Kenneth Waters is eliminated as the source of the male blood from the bathroom rug #3 [Item 1] in area A, the various linens on the floor near the hallway closet #10A [Item 4A], #10B.1 [Item 5A], #10B.2 [Item 6A], #10D [Item 7A], #10E [Item 8], and #10F [Item 9], and the blood on the living room carpet #21 [Item 14A].

Should you have any questions concerning this work, please contact us.

Sincerely,



Edward T. Blake, D.Crim.



Alan Keel, Criminalist

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Appendix 1:
Cumulative Frequency Data for the
D3S1358, vWA, FGA, D8S1179, D21S11, D18S51,
D5S818, D13S317, and D7S820 Genotypes

Item 1A. Blood from Bathroom Rug #3.

[Blood from Male #1]

Marker	Type	Frequency in Caucasians	Frequency in Blacks	Frequency in Mexican Americans
D3S1358	15,17	0.1210	0.1002	0.0994
vWA	15,17	0.0559	0.0753	0.0483
FGA	19,23	0.0155	0.0174	0.0326
D8S1179	10,13	0.0553	0.0142	0.0597
D21S11	30,31.2	0.0491	0.0220	0.0615
D18S51	12,15	0.0541	0.0206	0.0404
D5S818	12,12	0.1482	0.1196	0.0839
D13S317	12,12	0.0529	0.1487	0.0496
D7S820	8,11	0.0615	0.0571	0.0592
Cumulative Frequency		10-11.1	10-12.1	10-11.2
Cumulative %				
Reciprocal Frequency		1/134 billion	1/1.2 trillion	1/175 billion

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- Item 4A. Blood from Towel near Hallway Closet #10A.
 Item 5A. Blood from Linen near Hallway Closet #10B.1.
 Item 6A. Blood from Linen near Hallway Closet #10B.2.
 Item 7A. Blood from Linen near Hallway Closet #10D.
 Item 8. Blood from Linen near Hallway Closet #10E.
 Item 9. Blood from Linen near Hallway Closet #10F.

[Blood from Male #1]

Marker	Type	Frequency in Caucasians	Frequency in Blacks	Frequency in Mexican Americans
LOD1336	15,17	0.1210	0.1002	0.0994
vWA	15,17	0.0559	0.0753	0.0483
FGA	19,23	0.0155	0.0174	0.0326
D8S1179	10,13	0.0553	0.0142	0.0597
D21S11	30,31.2	0.0491	0.0220	0.0615
D18S51	NA			
D5S818	12,12	0.1482	0.1196	0.0839
D13S317	12,12	0.0529	0.1487	0.0496
D7S820	NA			
Cumulative Frequency		10 ^{-8.7}	10 ^{-9.1}	10 ^{-8.6}
Cumulative %				
Reciprocal Frequency		1/450 million	1/1.4 billion	1/420 million

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- Item 2. Blood from Left Side of Light Switch #7.
 Item 3. Blood from Hallway Wall #8 [except for D13S317].
 Item 10. Blood from Knife Blade #18.
 Item 11. Blood from Knife Hilt #18.
 [see also Item 13. Blood from Dining Room Table Top #20]

[Blood from Female #1]

Marker	Type	Frequency in Caucasians	Frequency in Blacks	Frequency in Mexican Americans
D3S1358	15,16	0.1223	0.1658	0.2299
VWA	15,16	0.0489	0.1004	0.0602
FGA	21,22	0.0458	0.0496	0.0307
D8S1179	10,10	<0.01	<0.01	<0.01
D21S11	28,29	0.0597	0.0789	0.0332
D18S51	NA			
D5S818	10,12	0.0366	0.0396	0.0258
D13S317	12,13	0.0472	0.1132	0.0529
D7S820	NA			
Cumulative Frequency		10 ^{-9.5}	10 ^{-8.5}	10 ^{-9.7}
Cumulative %				
Reciprocal Frequency		1/3.5 billion	1/340 million	1/5.2 billion

1. Frequency estimates for the Profiler Plus STR genes are based on a study of 200 Caucasians, 201 Blacks, and 202 Mexican Americans conducted by the Serological Research Institute; and a study of 200 Caucasians and 195 Blacks conducted by Applied Biosystems Division.
2. All individual genotype frequencies less than 1% [0.01] were rounded up to 1% [0.01].
3. The population of the Earth is estimated to be approximately 6 billion individuals. The total number of human beings who have ever lived is estimated to be 6 billion individuals.

STR Genes TABLE 1

Profiler Plus Genes

ITEM NO.	DESCRIPTION	Estimated DNA Conc. ng/ul	Sex	Blue			Green			Yellow		
				D3S1358 Type	vWA Type	FGA Type	D8S1179 Type	D21S11 Type	D18S51 Type	D5S818 Type	D13S317 Type	D7S820 Type
1A	Blood from Bathroom Rug #3, Area A	3.3	XY male	15,17	15,17	19,23	10,13	30,31.2	12,15	12,12	12,12	8,11
1B	Background from Bathroom Rug #3, Area B	<0.06	XY male	15,16 > 17	15,?	19,?	12 10?,13? 15?	20,?	NA	8,12	too weak	NA
2	Blood Stain from Left Side of Light Switch #7	<0.1	XX female	15,16	15,16	21,22	10,10	28,29	NA	10,12	12,13	NA
3	Blood Stain from the Hallway Wall Leading to the Front Bedroom #3	<0.1	XX female	15,16	15,16	21,22	10,10	28,29	NA	10,12	NA	NA
4A	Blood Stain from Light Green Towel on Floor in Front of Hallway Closet #10A, Area A	0.2	XY male	15,17	15,17	19,23	10,13	30,31.2	NA	12,12	12,12	too weak
4B	Background from Light Green Towel on Floor in Front of Hallway Closet #10A, Area B	<0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA: No Activity

NAI: No Activity Due to Inhibition

D: Degraded

H: High

M: Medium

L: Low

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STR Genes TABLE 1

Profiler Plus Genes

ITEM NO.	DESCRIPTION	Estimated DNA Conc. ng/ul	Sex	Blue			Green			Yellow		
				D3S1358 Type	vWA Type	FGA Type	D8S1179 Type	D21S11 Type	D18S51 Type	D5S818 Type	D13S317 Type	D7S820 Type
5A	Blood Stain from White Linen on Floor in Front of Hallway Closet #10B.1, Area A	0.1	XY male	15,17	15,17	19,23	10,13	30,31.2	NA	12,12	12,12	NA
5B	Background from White Linen on Floor in Front of Hallway Closet #10B.1, Area B	<0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
6A	Blood Stain from White Linen on Floor in Front of Hallway Closet #10B.2, Area A	0.2	XY male	15,17	15,17	19,23	10,13	30,31.2	NA	12,12	12,12	NA
6B	Background from White Linen on Floor in Front of Hallway Closet #10B.2, Area A	<0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7A	Blood Stain from Pink Floral Cloth on Floor in Front of Hallway Closet #10D, Area A	0.25	XY male	15,17	15,17	19,23	10,13	30,31.2	NA	12,12	12,12	NA
7B	Background from Pink Floral Cloth on Floor in Front of Hallway Closet #10D, Area A	<0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA: No Activity

NAI: No Activity Due to Inhibition

D: Degraded

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H: High

M: Medium

L: Low

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Profiler Plus Genes

ITEM NO.	DESCRIPTION	Estimated DNA Conc. ng/ul	Sex	Blue			Green			Yellow		
				D3S1358 Type	vWA Type	FGA Type	D8S1179 Type	D21S11 Type	D18S51 Type	D5S818 Type	D13S317 Type	D7S820 Type
8	Blood Stain from Pink Cloth on Floor in Front of Hallway Closet #10E	<0.06	XY male	15,17	15,17	19,23	10,13	30,31.2	12,7	12,12	12,12	NA
9	Blood Stain from Floral Print Cloth on Floor in Front of Hallway Closet #10F	0.1	XY male	15,17	15,17	19,23	10,13	30,31.2	too weak	12,12	12,12	NA
10	Blood from Knife Blade found in Kitchen Waste Basket #18	0.1	X>>Y female trace male	15,16 trace	15,16 trace	21,22 17	10,10 trace	28,29 13	NA	10,12	12,13	too weak
11	Blood from Knife Hilt found in Kitchen Waste Basket #18	0.1	XX female	15,16	15,16	21,22	10,10	28,29	too weak	10,12	12,13	too weak
12	Blood from Knife Crevice Side 2 found in Kitchen Waste Basket #18	<0.07	XX female	15,16	too weak	too weak	10,10	NA	NA	10,12	NA	NA
13	Blood Stain from Table Top in Dining Room #20	<0.06	XX female	15,16	15,16	too weak	10,10	NA	NA	10,12	NA	NA

NA: No Activity

NAI: No Activity Due to Inhibition

D: Degraded

H: High
M: Medium
L: Low

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Profiler Plus Genes

ITEM NO.	DESCRIPTION	Estimated DNA Conc. ng/ul	Sex	Blue			Green			Yellow		
				D3S1358 Type	yWA Type	FGA Type	D8S1179 Type	D21S11 Type	D18S51 Type	D5S818 Type	D13S317 Type	D7S820 Type
14A	Blood Stain from Living Room Carpet #21, Area A	1.0	XY male	15,7	15,17	NA	10,13	NA	NA	12,12	NA	NA
15	State Police Control Swab for Knife	<0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Extraction Blank	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Kit DNA Standard	0.1	XX female	14,15	17,18	23,24	13,13	30,30	15,19	11,11	11,11	10,11
	AMS DNA Standard	0.3	XX female	14,15	18,20	21,25	10,14	29,29	13,18	11,12	12,14	9,10
	PCR Blank	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA: No Activity
 NAI: No Activity Due to Inhibition
 D: Degraded

H: High
 M: Medium
 L: Low

Exhibit 128-2
 Profiler Plus Genes

ITEM NO.	DESCRIPTION	Estimated DNA Conc. ng/ul	Sex	Blue			Green			Yellow		
				D3S1358 Type	vWA Type	FGA Type	D6S1179 Type	D21S11 Type	D18S51 Type	D5S818 Type	D13S317 Type	D7S820 Type
17	Kenneth Waters, Reference Blood #W-39705 [Amplified 2/24/01]	40	XY male	16,18	14,17	21,22	10,15	29,29	13,15	12,13	8,11	10,12
	K1 DNA Standard [Amplified 2/24/01]	0.1	XX female	14,15	17,18	23,24	13,13	30,30	15,19	11,11	11,11	10,11
	AMS DNA Standard [Amplified 2/24/01]	0.3	XX female	14,15	18,20	21,25	10,14	29,29	13,18	11,12	12,14	9,10
	PCR Blank [Amplified 2/24/01]	0	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

NA: No Activity
 NAI: No Activity Due to Inhibition
 D: Degraded

11: High
 M: Medium
 L: Low

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PCR Based Analysis of STR Genes
from

Item 17. Kenneth Waters, Reference Blood.

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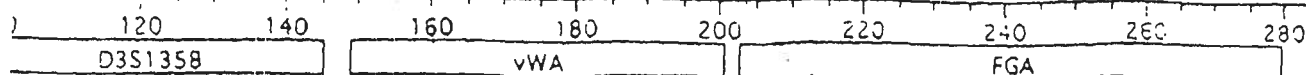


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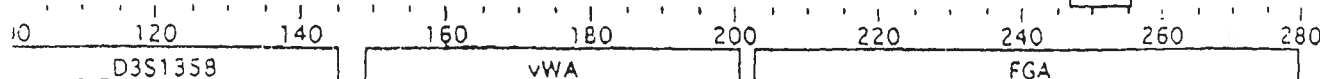
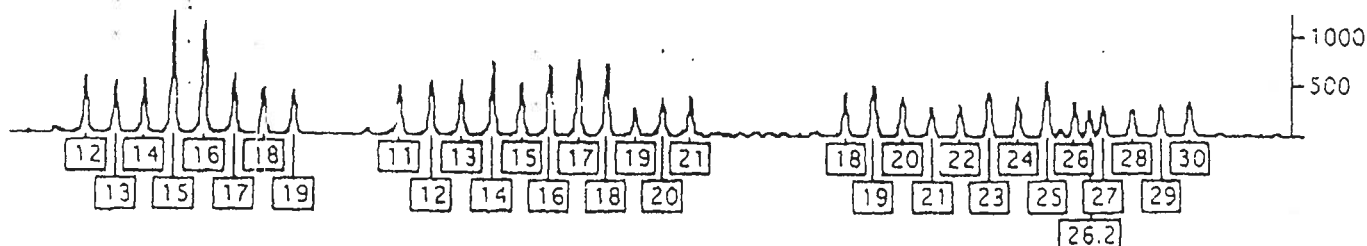
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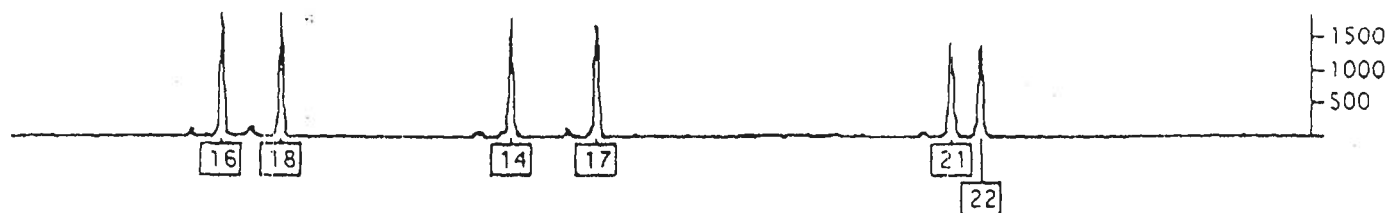
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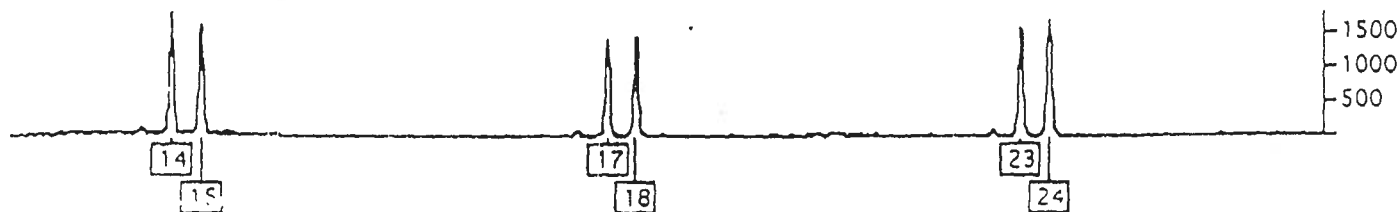
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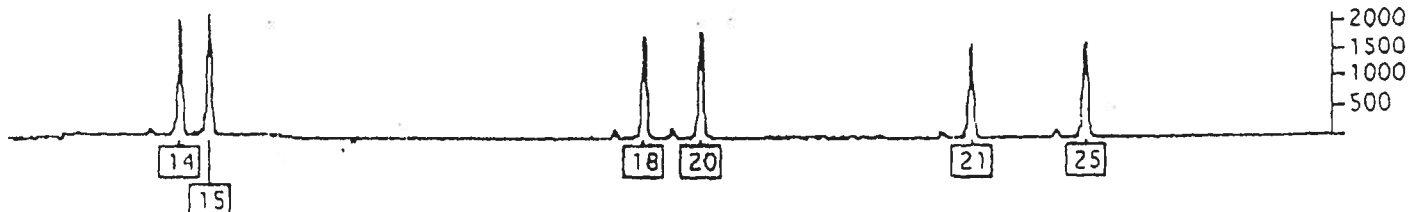
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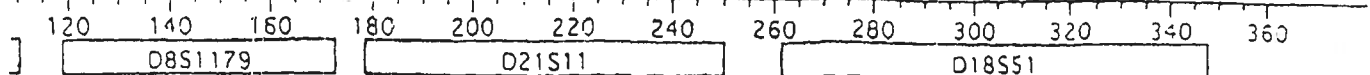
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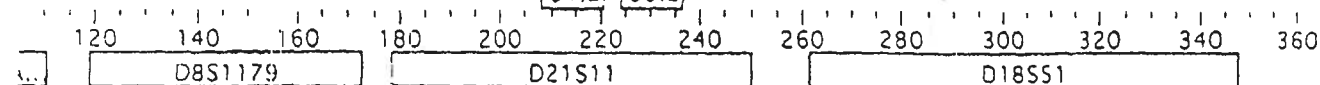
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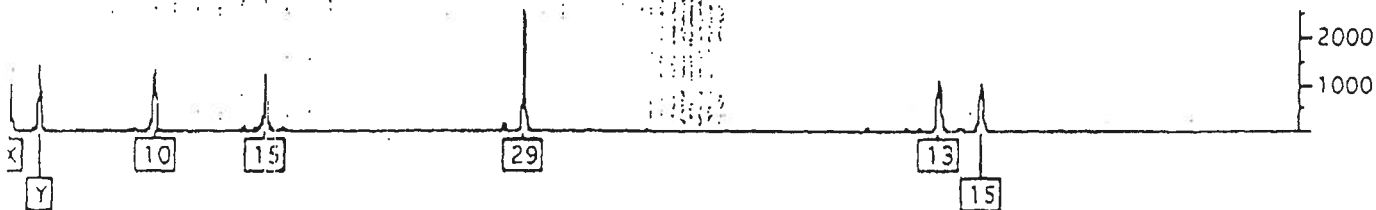

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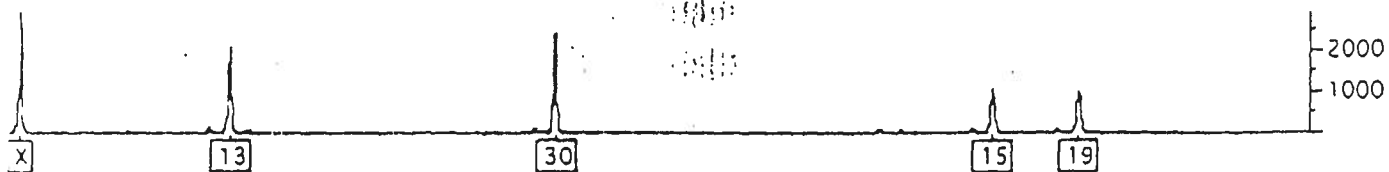
+ Ladder-2 15 Green Pro + Ladder



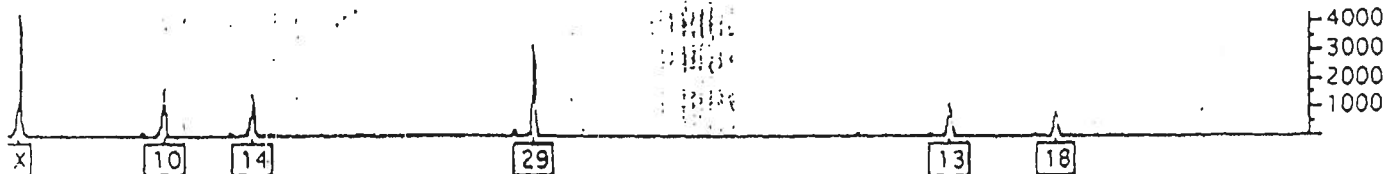
+ PCR 37 25 Green 00-6281171 Kenneth Waters, ref.



+ PCR 38-2 14 Green Kit DNA STD



+ PCR 39-2 16 Green AMS DNA STD



+ PCR 40 1 Green PCR Blank

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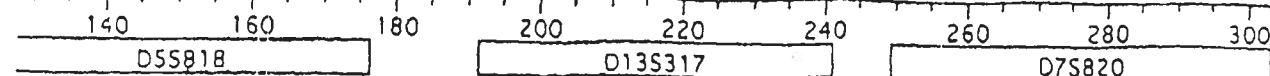
CRIME LAB

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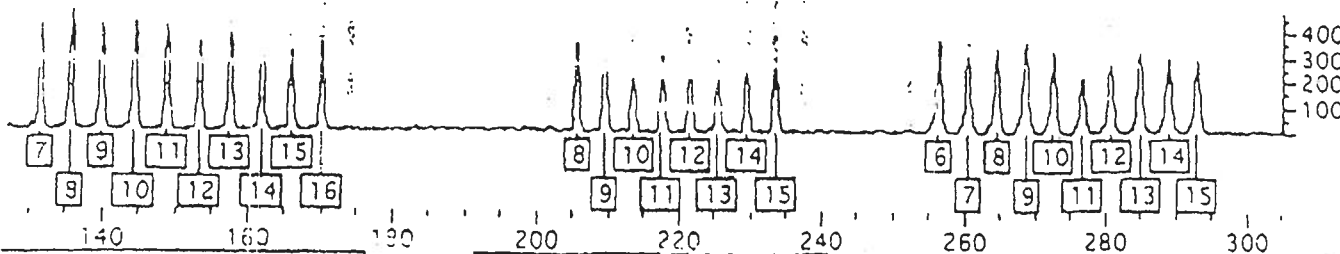


00-628 Pro+ 2/24/01 Yellow
Licensed to EDWARD T. BLAKE, FORENSIC SCIENCE ASSOCIATES

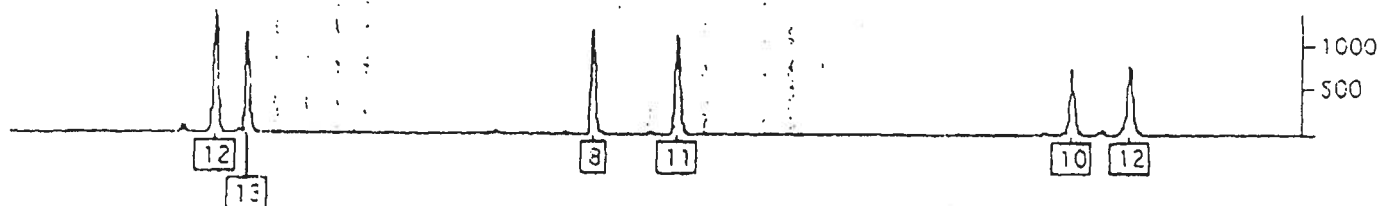
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Genotyper® 2.0



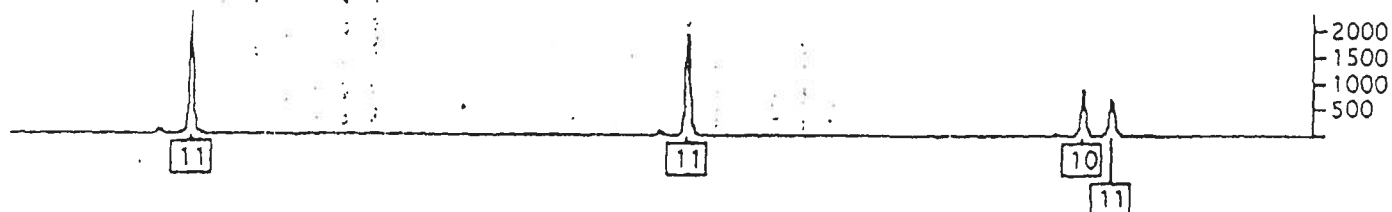
o + Ladder-2 15 Yellow Pro + Ladder



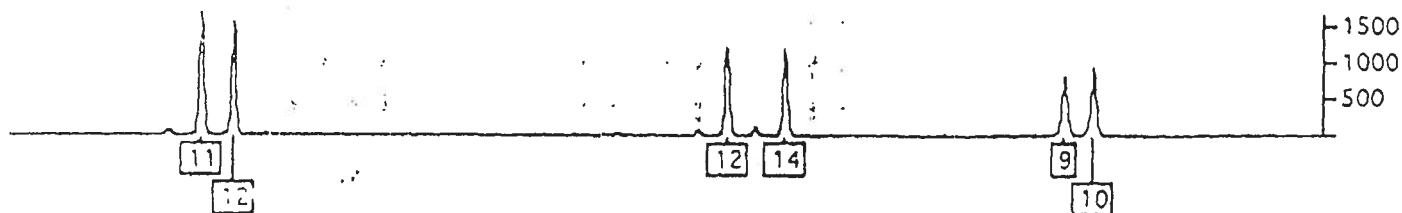
o + PCR 37 25 Yellow 00-628117/Kenneth Waters, ref.



ro + PCR 38-2 14 Yellow Kit DNA STD



Pro + PCR 39-2 16 Yellow AMS DNA STD



Pro + PCR 40 1 Yellow PCR Blank

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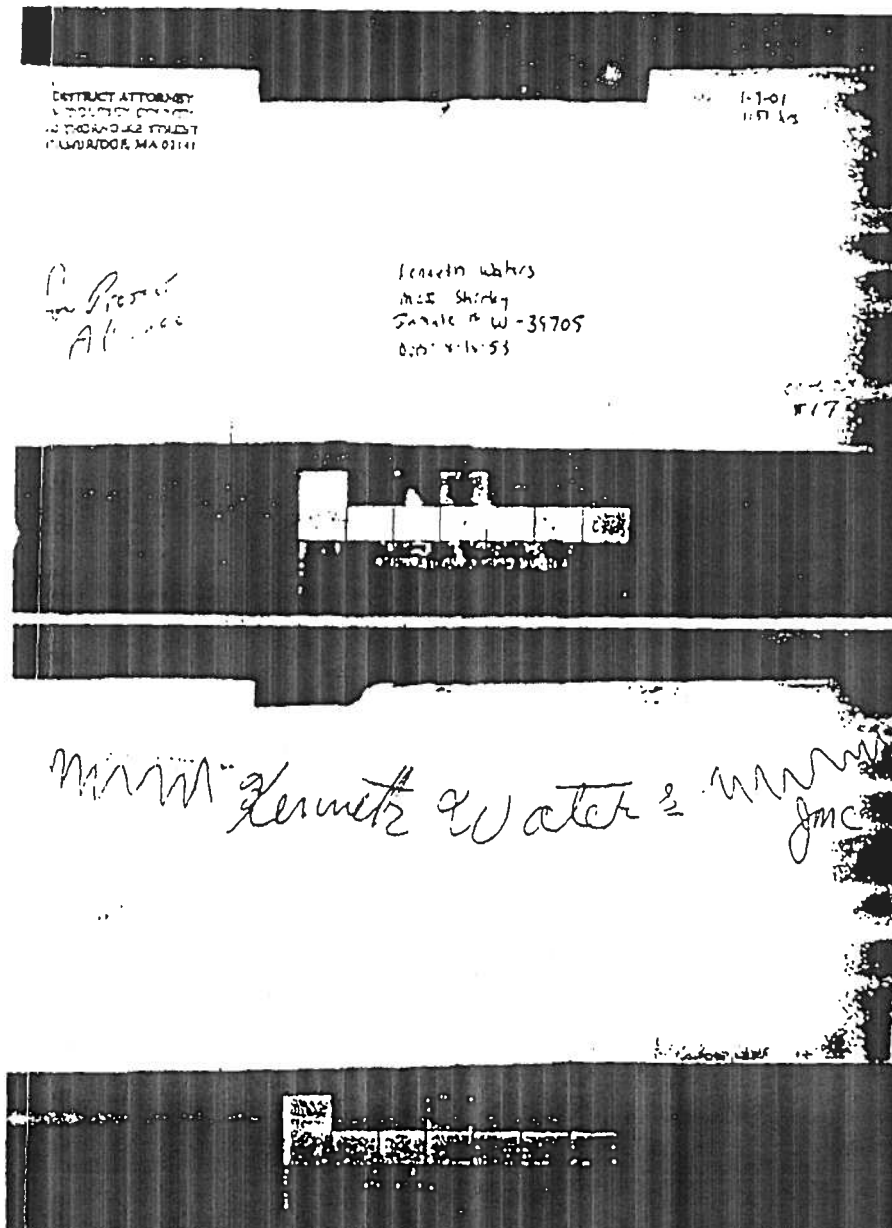


FIGURE 18
ITEM 17
REFERENCE BLOOD SAMPLE
FROM KENNETH WATERS
PACKAGING

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CRIME LAB

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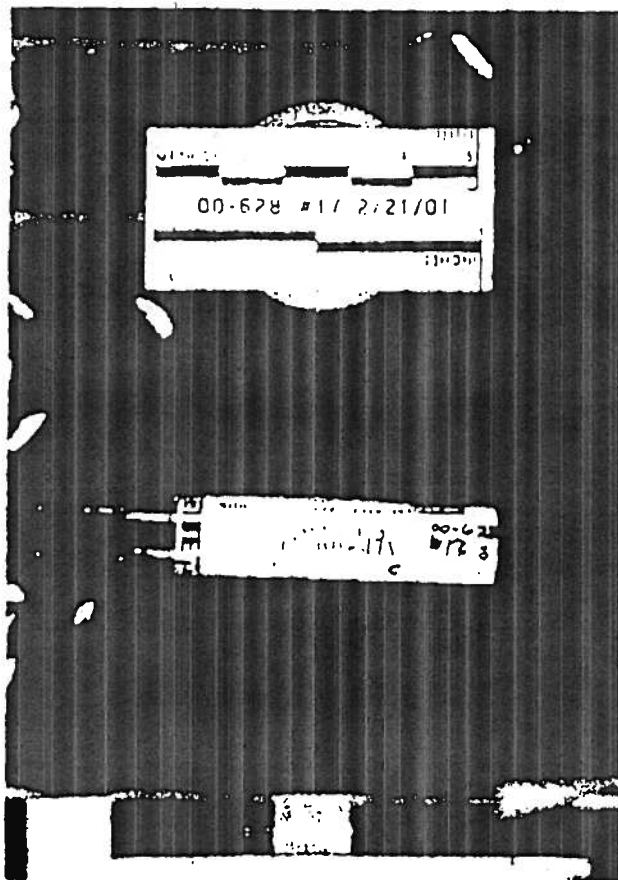


FIGURE 19
ITEM 17
REFERENCE BLOOD SAMPLE
FROM KENNETH WATERS
SHOWING LABELED
BLOOD TUBE